GM Powertrain Europe Engineering Center

Powertrain Electronic Control Units: development, models, analysis and tests according to General Motors

Alessandra Neri
Hardware Electrical Architecture Development Engineer

General Motors Company

DESIGN BUILD SELL
THE WORLD'S BEST VEHICLES

Who I am

Alessandra Neri
Hardware Electrical Architecture Development Engineer
Control System - Analysis & Simulation
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Education:
Politecnico di Torino:

- Professional Engineering Qualification
- PHD – Metrology – Electronic Measurement
- Electronic Engineering - Mater Degree and First Level Degree

GM vision and brands

General Motors Vision: Design, Build and Sell the World's Best Vehicles

HOLDEN

SAIC WU LING

FIRST AUTOMOTIVE WORKS

BAOJUN

DESIGN BUILD SELL

THE WORLD'S BEST VEHICLES

GM Powertrain 2005-2014

- GMPT-E Torino 8 years-old
- Total Site People: 550
- Average age 35 (25% under 30)
- 20% are women
- 50 new engineers in 2013
- Still growing…

GMPT-E Italy activities

Diesel Engine Engineering ← GLOBAL RESP IN TORINO

- Diesel Engine design and Simulation / Analysis
- Diesel Engine Validation and Testing
- Diesel Technologies Development (Injection,. Charging, Combustion, Aftertreatment

Controls Engineering ← GLOBAL RESP IN TORINO

- Diesel Control (HW&SW)
- Diesel Function and Algorithms
- Diesel Subsystem definition and EMS development

Diesel Hybrid Engineering ← GLOBAL RESP IN TORINO

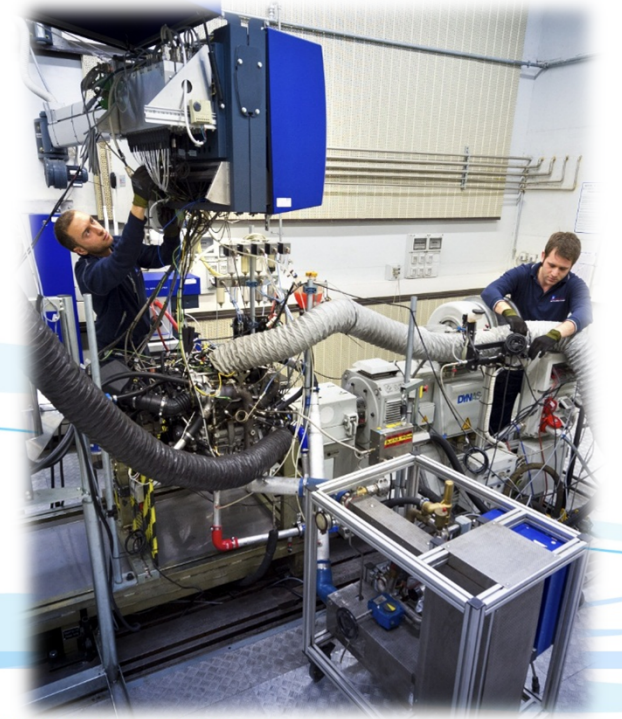
- Diesel Engine system configuration, modelling & optimization
- Diesel Hybrid verification

GMPT-E Italy Figures

- €30 million initial Investment
- 624 office places
- 15+4 Test Cells
- 6 Laboratories
- 4 Workshops
- 1 Chassis Dyno

50% of IP developed by GM Powertrain in Europe comes from Torino

€20 million new investment (2011-2014)

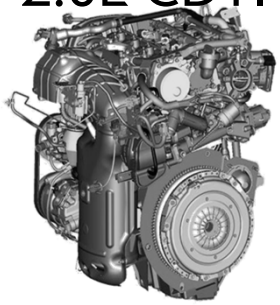


GMPT-E Italy Diesel Portfolio

1.6L CDTI

Opel Zafira

2.0L CDTI

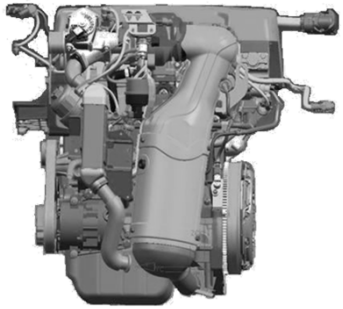


Opel Insignia

2.2L CDTI

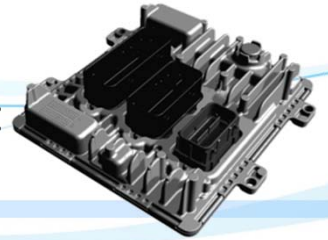
Opel Antara

1.3L CDTI



Opel Corsa

Controller D1Plus:



GMPT-E Italy Diesel Portfolio

2.5-2.8L

Chevrolet Colorado

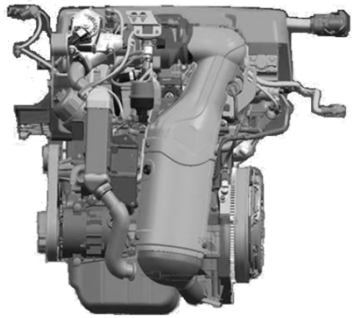
2.0L

Chevrolet Cruze

1.0L

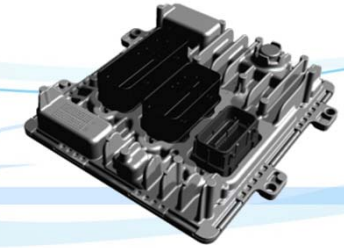
Chevrolet Beat

1.3L



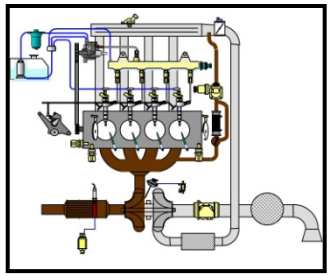
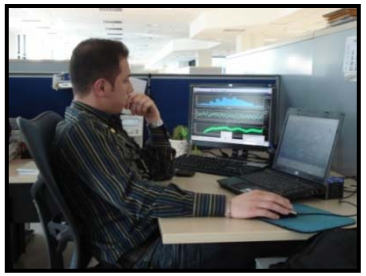
Chevrolet Sail

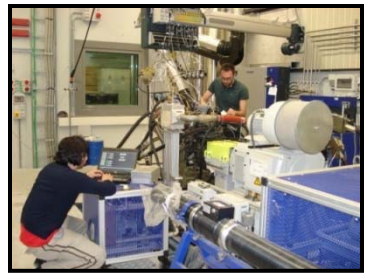
Controller D1Plus:



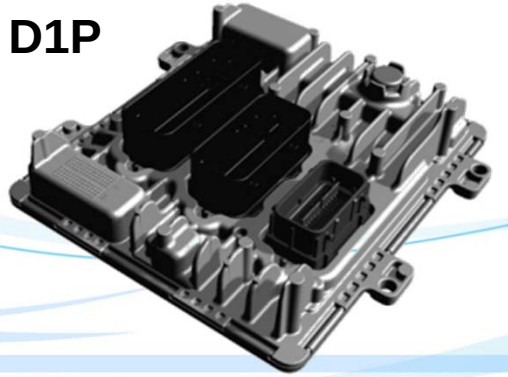
Engine Control System Development

Control System Architecture → Requirement Definition → Algorithm and Software Design → HW and SW test → Control System Validation



Controller D1P



Diesel controls development

Our Teams

Algorithm and software

✓Model based approach

✓Advanced signal processing and robust control

✓Rapid prototyping

✓Automatic code generation

Electronic Engineering

✓Electrical architecture and interface requirements

✓Worst case and variation analysis

✓Controller hardware engineering

✓Target software build

Control system tools and testing

✓HIL set up

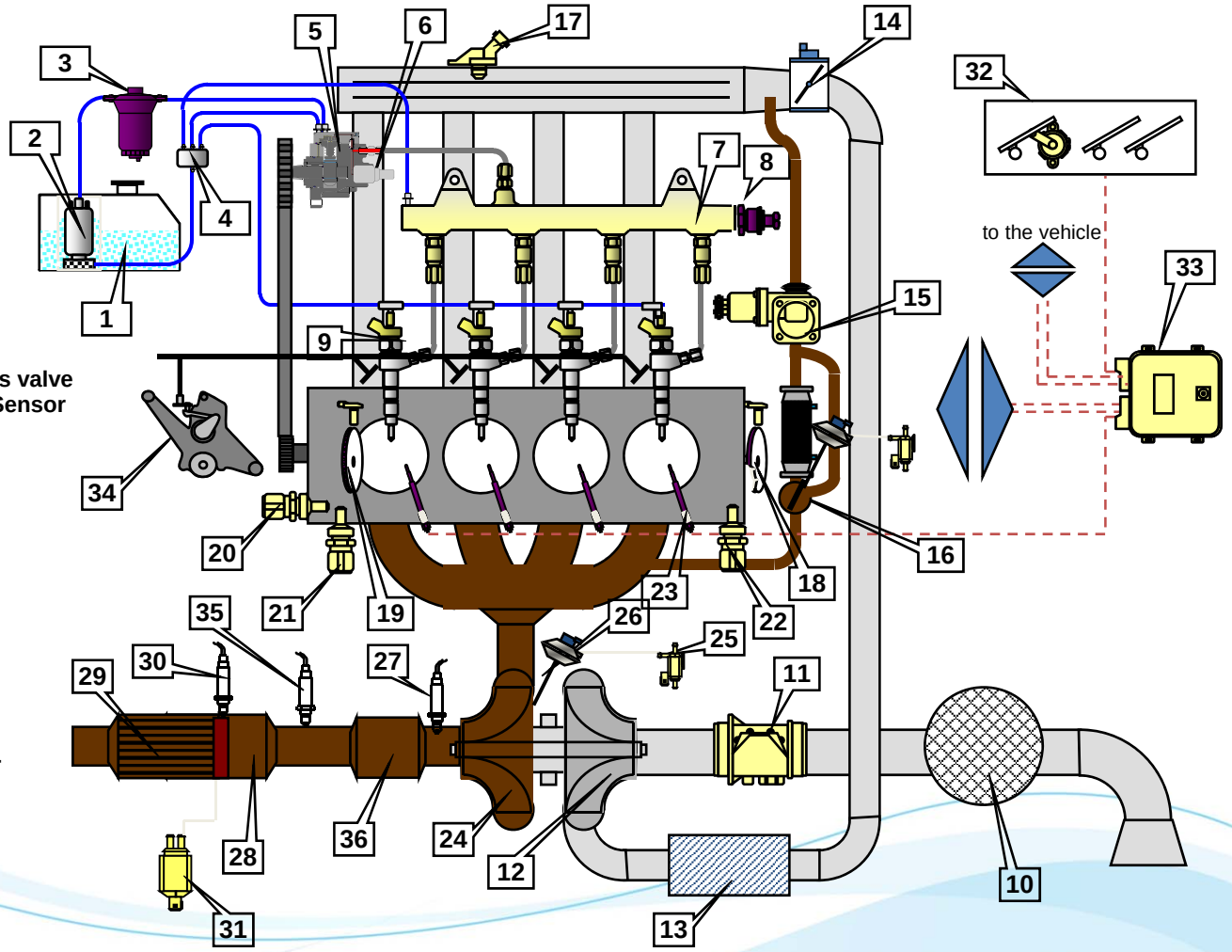
✓Tools development

✓Test automations

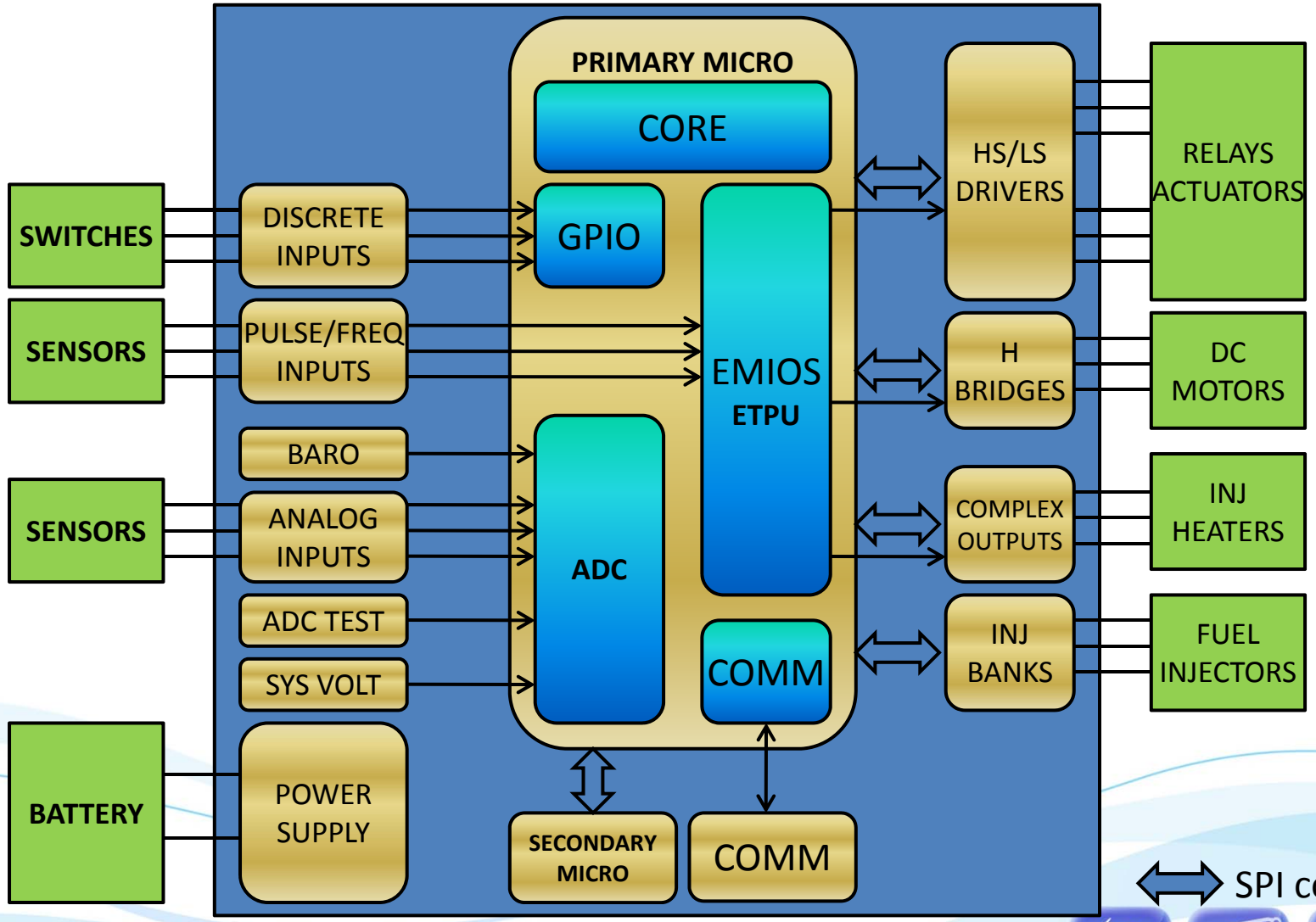
✓HIL testing

EURO5 typical architecture

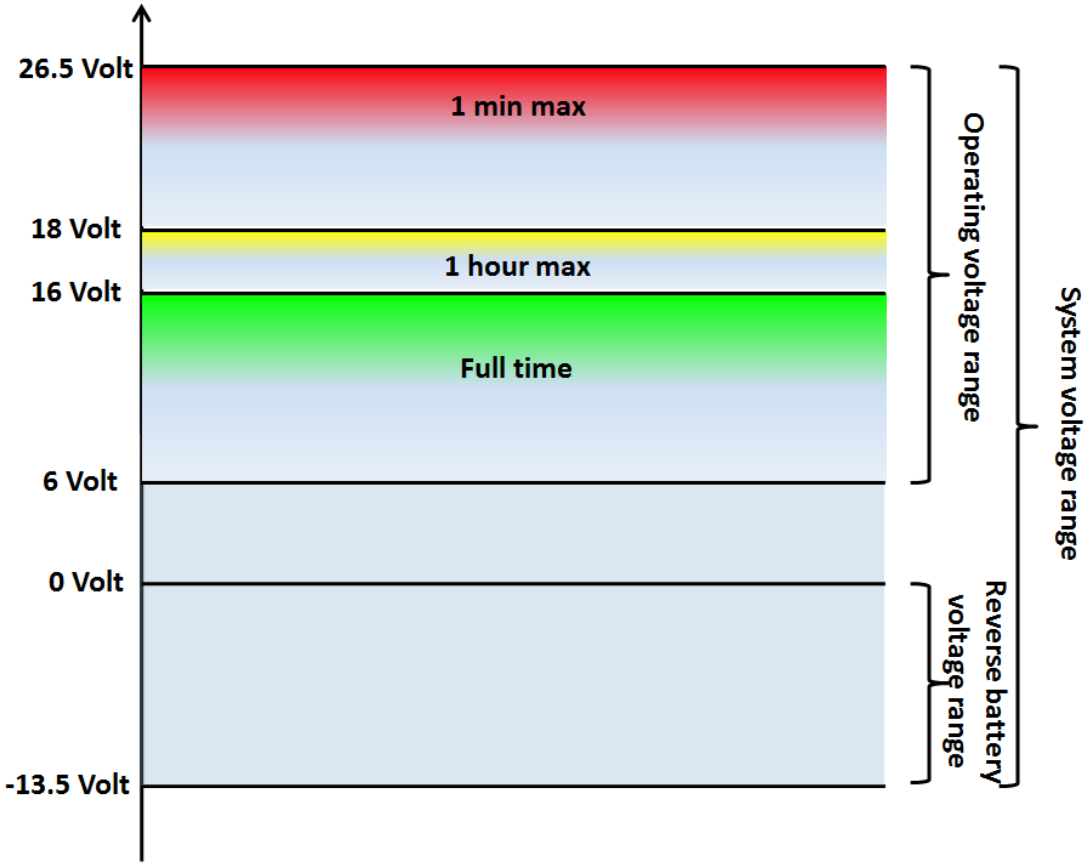
1. Tank
2. Electric Fuel-feeding Pump
3. Fuel Filter Assembly
4. Damper Volume
5. High Pressure Pump
6. Fuel metering Valve
7. Rail
8. Rail Pressure Sensor
9. Solenoid Injectors
10. Air Filter
11. Air Flow Meter (+Air Temperature Sensor)
12. Compressor
13. Intercooler
14. Electronic Throttle Body
15. Electronic EGR Valve
16. EGR Cooler with pneumatic on/off by-pass valve
17. Intake Manifold Pressure + Temperature Sensor
18. Crankshaft Position Sensor
19. Camshaft Position Sensor
20. Coolant Temperature Sensor
21. Oil Minimum pressure switch
22. Oil Level Sensor switch
23. Metallic/Ceramic Low Voltage Glow Plugs
24. Variable Geometry Turbine
25. VGT Vacuum Modulator
26. VGT position feedback
27. Lambda Sensor
28. Main Cat
29. Diesel Particulate Filter
30. Temperature Sensor
31. DPF Relative to Ambient Pressure Sensor
32. Pedal Assembly
33. ECU
34. Electronic Variable swirl actuator
35. Temperature Sensor
36. Pre Cat

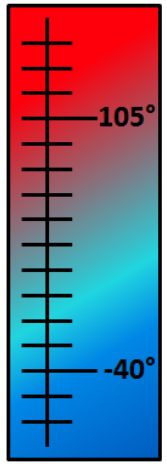


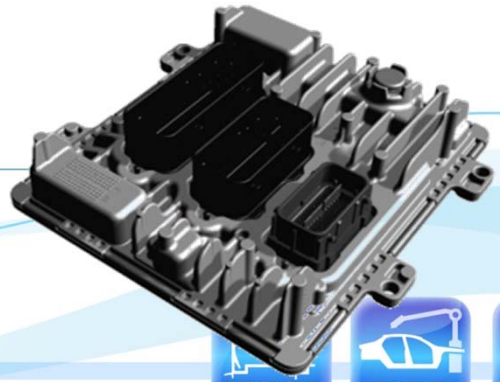
ECM: block diagram



ECU System voltage/temperature ranges







Q&A